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Fugitive Dust Emission Study for the City of Albuquerque

Engineering-Science, Inc, Arcadia, CA

Prepared for

Environmental Protection Agency, Dallas, TX Air and Hazardous Materials Div

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This study involved an emission inventory for fugitive dust sources in Albuquerque, New Mexico. Areas with a one mile radius were inventoried for five non-attaining particulate monitoring sites, with each site the center of the circle. Emissions from point sources within these areas were also included. Fugitive dust from unpaved roads and re-entrained dust from paved roads were the two primary contributors to air quality violations. The Air Quality Display Model (AQDM) was used to predict particulate concentrations and calculate the relative contribution of each point and area source.

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FOR THE CITY OF ALBUQUERQUE

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INTRODUCTION

In order to comply with federal regulations, it is necessary for the State of New Mexico to revise its State Implementation Plan (SIP) to show what steps will be taken to bring all areas in the State into compliance with National Ambient Air Quality Standards (NAAQS) by 1982. One such area, Albuquerque, must be brought into compliance with the NAAQS for particulate matter. To assist in determining what actions would be needed to accomplish this task, Engineering-Science (ES) was contracted by EPA Region 6 to define the magnitude and extent of the particulate problem and to estimate the emissions reductions which would be needed to achieve compliance with NAAQS for particulates.

The specific tasks performed by ES are outlined below:

1. Review and Update of Emission Data

   ES assembled, reviewed and updated the existing inventory to reflect 1977 emissions for point and area fugitive dust sources.

2. Dispersion Modeling

   The Air Quality Display Model (AQDM) was utilized to determine relative source contributions from both point and area sources.

The fugitive emissions generated from area sources are presented within this report in summary form. Those fugitive emissions resulting from point sources were collected and put on National Emissions Data System (NEDS) sheets. The NEDS forms were delivered to the Environmental Protection Agency under separate cover.

CHAPTER 1

SUMMARY

At present the National Ambient Air Quality Standards for total suspended particulate (TSP) is being violated in the Albuquerque area. It was determined that TSP levels were contributed to mostly by fugitive dust sources such as unpaved roads, dirt parking lots, re-entrained dust from paved roads, aggregate storage, and a general background concentration which is associated with the geography and climatology of New Mexico.

In evaluating the fugitive dust emission sources, Engineering-Science personnel determined some of the High Volume particulate monitors to be placed in some locations that may be biased by nearby dirt roads and parking lots. Also, re-entrained dust on paved roads proved to be a substantial contributor, since many driveways are unpaved and lead to major thoroughfares as do some major unpaved roads.

The field information gathered by ES personnel was coded on National Emission Data Forms (for point sources), thereby updating the file. Area source emissions and point source emissions were then input to the EPA's Air Quality Display Model. The computer model was calibrated with monitoring station data from stations 2A, 2C, 2P, and 2K. The model yielded good results and was found to adequately predict annual average TSP concentrations. The model calculated the total particulate loading and the relative source contribution of each point and area source.

CHAPTER 2

EMISSION INVENTORY

The emission inventory is an extensive listing of all stationary point sources such as industrial or utility and area sources such as unpaved roads and re-entrained street dust. The particulate emissions from all possible sources were then tabulated. A majority of this work was conducted by automobile and on foot. It involved considerable engineering judgment in determining the extend of these sources and to determine whether the chosen emission factors were applicable and adequate.

Fugitive dust calculations basically utilize two types of information, vehicle miles traveled (VMT) and a dust emission factor which is a combination of specific conditions. The methodology used in compiling this inventory is described in the following section.

In addition to the area source information, the point source inventory was also compiled and catalogued on NEDS forms. The procedure for coding the NEDS forms is presented in the following section.

VEHICLE MILES TRAVELED (VMT)

The VMT for urban areas was calculated from average daily traffic flow diagrams prepared by the Middle Rio Grande Council of Governments and City of Albuquerque Transportation Department. For rural areas the VMT was calculated from aerial photographs obtained from the Albuquerque Department of Urban Planning. Vehicle counts were estimated based on observations made at each of the study sites. The mileage was simply measured from the aerial photos by converting inches to miles.

EMISSION FACTORS AND INVENTORIES

The fugitive dust emission factors were derived from a "Compilation of Air Pollution Emission Factors", (AP-42) published by the EPA. The emission factor utilized was calculated using soil silt content, rainfall and average vehicle speed. All criteria, of course, were specific to the Albuquerque area. These criteria varied with respect to unpaved roads, driveways or parking lots, but it is the speed of the vehicle and the number of tires which most influence the factor in specific areas.

The variables are as follows:

$$E = \left(0.81\ s\right)\left(\frac{S}{30}\right)\left(\frac{365 - w}{365}\right)$$

where: E = Emission factor, pounds per vehicle-mile;
s = Silt content of road surface material, percent;
S = Average vehicle speed, miles per hour;
w = Mean annual number of days with 0.01 in. (0.254 mm) or more of rainfall.

The equation is valid for vehicle speeds in the range of 30-50 mi/hr (48-80 km/hr).

AREA SOURCES

The area source emission inventory was compiled based on the above equation. Each of five sites was visited and a High Volume Sampler was located, which measures the average level of suspended particulate matter at the site.

A one-mile radius search, beginning at the High Volume monitor was conducted by automobile. Of special concern were the unpaved dirt or gravel roads, especially those frequently traveled. These were located and marked on teh aerial photographs. Unpaved parking lots and access ways were also identified and estimates were made regarding traffic flow. These particulate area sources were determined to be the highest contributors; however, the following sources of fugitive dust were also assumed to contribute to each Hi-Vol monitor.

- Paved Road Re-entrained Dust
- Tire and Exhaust Particulate
- Wind-blown Dust from Natural Causes
- Mineral Dust from Aggregate Storage

The total emissions for each one-mile radius study site were calculated by type of road (for those particular sites with unpaved roads) by assuming a silt content of 20 percent (from soil conservation maps) and an average speed of 35 MPH (16 m/sec) as an upper limit, and by obtaining the number of days with 0.01 inches (0.25 mm) or more of rainfall.

Once all the criteria and conditions were established, each site was gridded into 0.5 km squares on the aerial photo and given a letter designation.

All fugitive source calculations were figured per square and located by Universal Transverse Mercator (UTM) coordinates. This information was then fed into EPA's Air Quality Display Model (AQDM) along with the 1977 Albuquerque Stability Wind Rose, resulting in particulate concentrations ($\mu g/m^3$) and percent contributions of each point and area source to the total calculated concentration at each High Volume Monitor.

Estimates of re-entrained dust emissions from paved roads were based on a draft report, "Quantification of Dust Entrainment from Paved Roads", prepared by the EPA, Office of Air Quality Planning and Standards, dated 31 March 1976. The assumed emission factor for all five monitoring sites was 0.13 pounds per vehicle mile traveled.

The EPA study entitled "Report on Fugitive Dust", EPA 450/3-74-037 was utilized by ES for calculating emissions from storage piles. An emission factor of .33 lbs/ton of material placed in storage or 10.4 lbs/acre/day, was corrected for climatological influence with Thornthwaite's precipitation-evaporation index (PE). The PE for Bernalillo County from the PE map is 35. The equation in tons per acre per day of particulate is:

$$E = \frac{.33 \text{ (tons/acre/day of material placed in storage)}}{\frac{(PE)^2}{100}}$$

The tire and exhaust particulate matter emissions were calculated as suggested in AP-42, Table 3.1.2-13, and allocated to the specific grids for computer modeling.

Wind-blown dust was estimated based on equations recommended for agricultural tilling in "Development of Emission Factors for Fugitive Dust Sources", EPA-450/3-74-037, June 1974. The emissions were calculated utilizing the following equation:

$$E = aIKCLV$$

Where:

E = suspended particulate fraction of wind erosion losses of (open) tilled fields, tons/acre/year

a = portion of total wind erosion losses that would be measured as suspended particulate, estimated to be 0.025

I = soil erodibility, tons/acre/year

K = surface roughness factor, dimensionless (in these calculations ES used 0.75)

C = climatic factor, dimensionless (calculated in percent)

L = unsheltered field width factor, dimensionless (ES used 1.0)

V = vegetative cover factor, dimensionless (calculated from other information)

The soil maps obtained from the USDA Soil Conservation Service are delineated by soil associations (grouping similar soil classes into one general classification). The appropriate "I" value for each soil association was computed by the weighted percent of each soil class within that soil association.

The "K" factor, surface roughness, accounts for the roughness of soil surface in resisting soil erosion. For open desert, 0.75 was used. The "C" factor, climatic, is a measure of climatic conditions affecting soil erosion. ES used the climatic factor for New Mexico as determined by the USDA Soil Conservation Service. For the emission grid system used in this study, the "L" factor, field length, was assumed to be equal to one. Some soil associations, within emission grids may not require an assumption of less than or equal to one because of topographical features that would restrict wind flow. However, the assumption is thought to be adequate for the large emission grids that were selected. The "V" factor, vegetation cover, is a measure of the sheltering effect of the vegetation in reducing soil erosion. It was computed by knowing IKCL and the estimated dry grain crop residue equivalent for the vegetation for each soil associate which was furnished by the USDA. The factor was in the range of 0 to 1.0. If large amounts of vegetation were on the soil association, then a small "V" factor would be calculated.

POINT SOURCES

Using the assumption that point sources such as asphalt batch plants, ready-mix concrete plants, and gravel crushers all had adjacent aggregate storage piles, the aggregate storage emissions were developed from AP-42. This was explained in the "Area Sources" section of this report. Other point sources which were evaluated for fugitive dust emissions were vermiculite facilities, airports and power plants.

NATIONAL EMISSIONS DATA SYSTEM

The EPA has developed in inventory system designed to categorize the emissions from air pollution point sources nation-wide. This inventory is called the National Emissions Data System (NEDS) and is updated on a yearly basis. Due to the nature of the NEDS format, data can be conveniently stored on computer punch cards.

The data includes the name, location, equipment and controls, control efficiencies, emissions and operation rates of specific emission points within commercial and public facilities. All of the information is coded in such a way that it may be directly input to the Air Quality Display Model (AQDM) developed by the EPA.

In Albuquerque, much of the necessary data for the NEDS forms were obtained from the Albuquerque Department of Environmental Health, Air Resources Division (ARD) files. The ARD secured its information via questionnaires sent to all potential air pollution emitters. ES personnel utilized these completed NEDS forms to update the emission inventory and calculate the annual average particulate concentrations.

The accuracy of the NEDS information was determined through spot checking specific sources and making engineering judgments as to fugitive emissions. The Kirtland Air Force Base and Sandia Labs were two of those inspected. No discrepancies in the information were encountered and no additional sources were found.

Completion of the NEDS forms required the use of several documents in order to obtain the appropriate NEDS codes. These documents included:

Guide for Compiling a Comprehensive Inventory, APTD-1135;
SAROAD Station Coding Manual for Aerometric Sampling Networks, APTD-0907;
Federal Air Quality Control Regions, AP-102;
Standard Industrial Classification Manual, 1972;
Compilation of Air Pollutant Emission Factors, Second Edition, AP-42;
and SCC listing.

In addition to the coded information, Universal Transverse Mercator (UTM) coordinates must be included to insure the exact geographic location of the point source.

Twenty-nine facilities emitting air pollutants and 126 point sources incorporated within those facilities in Bernalillo County were coded into NEDS forms by Engineering-Science.

CHAPTER 3

DISPERSION MODELING

This section summarizes the dispersion modeling conducted by ES, how it was utilized, and the results. The High Volume monitoring site descriptions are included and may give some insight into the nature of the results.

Engineering-Science utilized EPA's Air Quality Display Model (AQDM), designed to relate emissions (tons/day) and meteorology to predicted annual average concentrations ($\mu g/m^3$) and relative source contribution (percent). By utilizing this model, source receptor relationships can be identified. A complete description and example of the model is presented in the appendix.

HIGH VOLUME MONITOR SITES

Within the Albuquerque area there are 26 High Volume samplers in regular operation. The Environmental Protection Agency determined that five of the monitors were in non-attainment areas. That is, these particular sites did not meet or "attain" the National Ambient Air Quality Standard (NAAQS) for total suspended particulate matter of 75 $\mu g/m^3$ (annual geometric mean). Of the 26 total High Volume monitoring sites in the Albuquerque area, five were in violation of the standard. Site 2A was in violation by 31 $\mu g/m^3$, site 2C by 91 $\mu g/m^3$, site 2G by 38 $\mu g/m^3$, site 2P by 26 $\mu g/m^3$, and site 2K by 14 $\mu g/m3$.

These five monitoring sites were examined more closely to identify the area and point sources which contributed most to the violations.

Short site descriptions follow.

Site 2A

In the central part of Albuquerque, the Hi-Vol is perched atop the YMCA building. It is surrounded by dirt parking lots which are used by considerable numbers of cars. Directly in front of the monitor is the train switch yard. Four or five trains traverse this way daily. The area surrounding the monitor consists almost entirely of paved streets and highways.

Site 2C

The Hi-Vol is located on top of a 25 to 30 foot storage tank. This tank has a dirt road on one side and two dirt roads parallel to each other on the other side. All three roads have frequent automobile traffic. This particular site maintains a considerable amount of re-entrained dust since many highly traveled unpaved roads lead to the main paved highway. At the northeast portion of the site there is a sand and gravel yard with an unpaved accessway, which is utilized by dumpsters and eighteen wheel haulers.

Site 2G

This monitor is located on top of a building in a fully paved parking lot of the city yard. However, the site itself is largely unpaved and heavily traveled by a wide range of vehicles. In addition to this, the area surrounding the site is unpaved and largely open desert with sparse vegetation.

Site 2P

The monitor for this site is on the roof of the fire station on Indian School Road, N.E. There is a short unpaved road and a small unpaved parking lot adjacent to the fire station. Though this site is mostly paved highways and freeways, (within a 1/4 mile radius of the monitor), there is a large unpaved school parking lot approximately a half block east. This lot contains 50 to 70 cars, many of which leave and return during the noon hour.

Site 2K

The monitor in this site is on top of a fire station at Chico and Dallas. The station itself is surrounded by unpaved lots, either vacant or with a few parked cars. One of the unpaved lots is a trailer sales yard. This site is also the location of the State Fair with a very large unpaved parking lot which is used not only for the duration of the fair, but also on weekends for a flea market, which involves many automobiles stirring up dust. Many of the residences in this site have unpaved driveways and this results in a considerable amount of re-entrained dust. However, the majority of this site consists of paved highways. The unpaved areas are within an approximate 1/2 mile radius of the monitor.

DISPERSION MODELING RESULTS

The results determined from the modeling are as follows:

Site	National Ambient Air Quality Standards	Observed Value ($\mu g/m^3$) (From Hi-Vol)	Calculated Value ($\mu g/m^3$) (From Model)
2A	75 $\mu g/m^3$	106	112
2C	"	166	157
2G	"	113	124
2P	"	101	91
2K	"	89	87

The calculated value includes all contributing point and area sources and a natural background of 20.00 $\mu g/m^3$. The following set of tables summarize each of the non-attainment monitoring sites. Each source is identified as to its emission in tons per day, its concentration contribution in micrograms per cubic meter, and its percent contribution to the total site.

The correlation of the model was very good, .9414 (perfect correlation is a slope of one). Figure 3-1 represents this calibration of calculated versus observed values.

TABLE 3-1

PREDICTED ANNUAL TOTAL SUSPENDED PARTICULATE CONCENTRATIONS

SITE 2-A

Sources Within One Mile Radius	Emissions (Tons/Day)	Contribution to Calculated Ambient Concentration ($\mu g/m^3$)
Unpaved Roads	(a)	
Re-entrained Dust	(a)	
Tire and Exhaust	.681	25.361
Unpaved Parking Lots	.927	34.848
Misc. (Locomotives)	.250	11.356
Total	1.858	71.565

Source Category	Contribution to Calculated Ambient Concentrations ($\mu g/m^3$)	(% Total)
One Mile Radius Sources	72	64 or 33(b)
Unpaved Roads	(a)	
Re-entrained Dust	(a)	
Tire and Exhaust	(25)	22
Unpaved Parking Lots	(35)	31
Misc. (Locomotives)	(11)	10
Other Sources in Emission Inventory	21	19
Background Sources	20	18
Total Calculated Value	113	100
Observed Value (from monitor)	106	

(a) This source was not a high contributor at this site (<1%).

(b) First value includes the background sources' contribution, second value does not.

TABLE 3-2

PREDICTED ANNUAL TOTAL SUSPENDED PARTICULATE CONCENTRATIONS

SITE 2-C

Sources Within One Mile Radius	Emissions (Tons/Day)	Contribution to Calculated Ambient Concentration ($\mu g/m^3$)
Unpaved Roads	2.644	76.2852
Re-entrained Dust	0.536	17.9039
Tire and Exhaust	0.075	.8675
Unpaved Parking Lots	0.171	.9525
Misc.	(a)	
Total	3.426	96.0091

Source Category	Contribution to Calculated Ambient Concentrations ($\mu g/m^3$)	(% Total)
One Mile Radius Sources	96	61 or 38[b]
Unpaved Roads	(76)	48
Re-entrained Dust	(18)	11
Tire and Exhaust	(a)	
Unpaved Parking Lots	(1)	0
Misc.	(a)	
Other Sources in Emission Inventory	41	26
Background Sources	20	13
Total Calculated Value	157	100
Observed Value (from monitor)	166	

(a) This source was not a high contributor at this site (<1%).

(b) First value includes the background sources' contribution, second value does not.

TABLE 3-3

PREDICTED ANNUAL TOTAL SUSPENDED PARTICULATE CONCENTRATIONS

SITE 2-G

Sources Within One Mile Radius	Emissions (Tons/Day)	Contribution To Calculated Ambient Concentration ($\mu g/m^3$)
Unpaved Roads	2.867	64.4982
Re-entrained Dust	(a)	
Tire and Exhaust	(a)	
Unpaved Parking Lots	(a)	
Misc.	(a)	
Total	2.867	64.4982

Source Category	Contribution to Calculated Ambient Concentrations ($\mu g/m^3$)	(% Total)
One Mile Radius Sources	64	52 or 30[b]
Unpaved Roads	(64)	52
Re-entrained Dust	(a)	
Tire and Exhaust	(a)	
Unpaved Parking Lots	(a)	
Misc.	(a)	
Other Sources in Emission Inventory	40	32
Background Sources	20	16
Total Calculated Value	124	100
Observed Value (from monitor)	113	

(a) This source was not a high contributor at this site (<1%).

(b) First value includes the background sources' contribution, second value does not.

TABLE 3-4

PREDICTED ANNUAL TOTAL SUSPENDED PARTICULATE CONCENTRATIONS

SITE 2-P

Sources Within One Mile Radius	Emissions (Tons/Day)	Contribution to Calculated Ambient Concentration ($\mu g/m^3$)
Unpaved Roads	0.020	1.045
Re-entrained Dust	0.031	2.203
Tire and Exhaust	0.213	13.995
Unpaved Parking Lots	0.230	20.645
Misc.	(a)	
Total	0.494	37.888

Source Category	Contribution to Calculated Ambient Concentrations ($\mu g/m^3$)	(% Total)
One Mile Radius Sources	38	42 or 11[b]
Unpaved Roads	(1)	1
Re-entrained Dust	(2)	2
Tire and Exhaust	(14)	15
Unpaved Parking Lots	(21)	23
Misc.	(a)	
Other Sources in Emission Inventory	33	36
Background Sources	20	22
Total Calculated Value	91	100
Observed Value (from monitor)	101	

(a) This source was not a high contributor at this site (<1%).

(b) First value includes the background sources' contribution, second value does not.

TABLE 3-5

PREDICTED ANNUAL TOTAL SUSPENDED PARTICULATE CONCENTRATIONS

SITE 2-K

Sources Within One Mile Radius	Emissions (Tons/Day)	Contribution to Calculated Ambient Concentration ($\mu g/m^3$)
Unpaved Roads	(a)	
Re-entrained Dust	0.046	3.200
Tire and Exhaust	0.004	0.205
Unpaved Parking Lots	0.012	0.379
Misc. (Unpaved Driveways)	0.212	35.731
Total	0.274	39.515

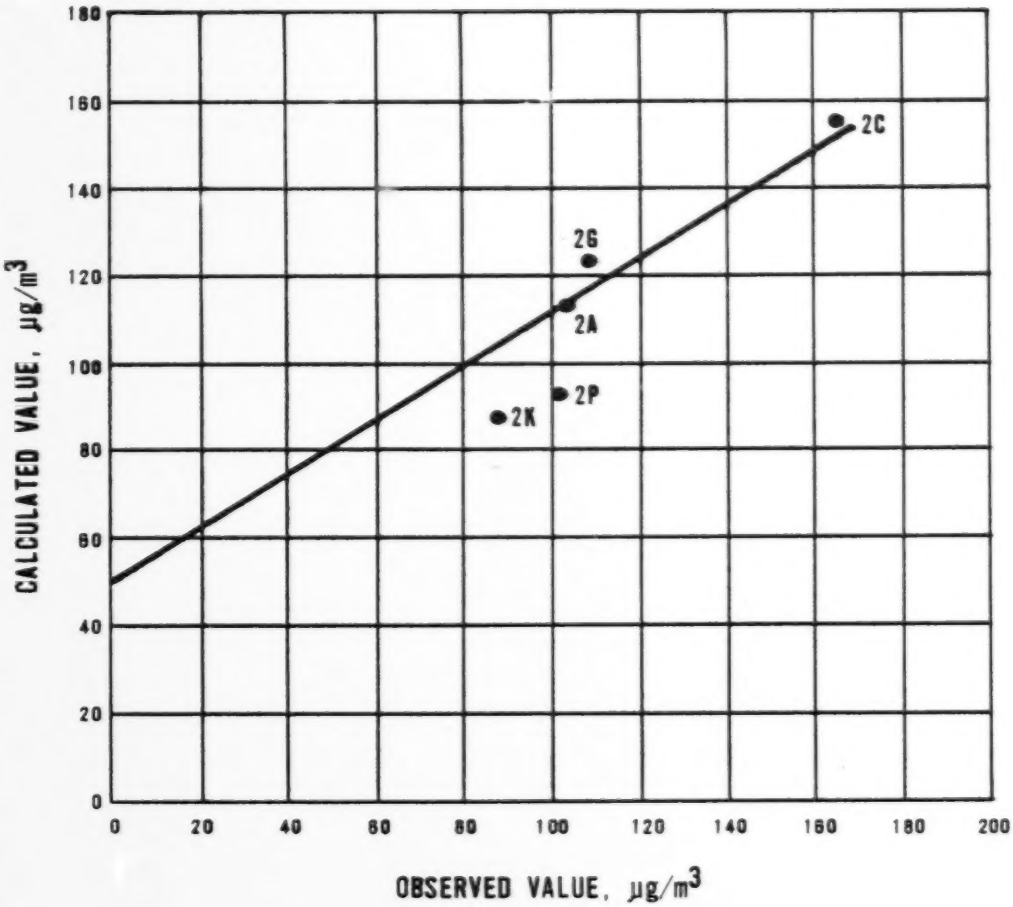
	Contribution to Calculated Ambient Concentrations	
Source Category	($\mu g/m^3$)	(% Total)
One Mile Radius Sources	39	44 or 11[b]
Unpaved Roads	(a)	
Re-entrained Dust	(3)	3
Tire and Exhaust	(a)	
Unpaved Parking Lots	(a)	
Misc. (Unpaved Driveways)	(36)	41
Other Sources in Emission Inventory	29	33
Background Sources	20	23
Total Calculated Value	88	100
Observed Value (from monitor)	89	

(a) This source was not a high contributor at this site (<1%).

(b) First value includes the background sources' contribution, second value does not.

FIGURE 3-1

CALCULATED VS. OBSERVED CONCENTRATION VALUES



SOURCE DATA

SOURCE NUMBER	SOURCE LOCATION (KILOMETERS) HORIZONTAL	VERTICAL	SOURCE AREA SQUARE KILOMETERS	ANNUAL SOURCE EMISSION RATE (TONS/DAY) SO2	PART	STACK DATA HT (M)	DIAM (M)	VEL (M/SEC)	TEMP (DEG K)	
1	353.6	3890.7	0.00	0.000	0.010	10.7	0.7	6.1	298.	1 Albuquerque Gravel
2	353.6	3890.7	0.00	0.000	0.140	9.1	2.0	3.0	298.	2 Albuquerque Gravel pt 2
3	360.2	3879.1	0.00	0.000	0.005	10.7	0.7	6.1	298.	3 Albuquerque Gravel Eubank
4	354.8	3893.0	0.00	0.000	0.470	27.4	0.6	15.2	422.	4 American Gypsum
5	352.0	3888.0	0.00	0.000	0.020	8.2	1.0	8.4	316.	5 Hale Construction
6	371.2	3881.7	0.00	0.000	0.020	29.3	0.7	16.6	350.	6 Ideal Cement pt 14
7	373.2	3881.7	0.00	0.000	0.010	29.3	0.5	11.4	333.	7 Ideal Cement pt 15
8	373.2	3881.7	0.00	0.000	0.010	29.3	0.6	23.6	300.	8 Ideal Cement pt 16
9	371.2	3881.7	0.00	0.000	0.010	25.0	0.3	22.9	298.	9 Ideal Cement pt 17
10	373.2	3881.7	0.00	0.000	0.010	25.0	0.3	22.9	298.	10 Ideal Cement pt 18
11	373.2	3881.7	0.00	0.000	0.010	25.0	0.3	22.9	298.	11 Ideal Cement pt 19
12	371.2	3881.7	0.00	0.000	0.010	25.0	0.3	22.9	298.	12 Ideal Cement pt 20
13	373.2	3881.7	0.00	0.000	0.010	28.7	0.4	15.9	298.	13 Ideal Cement pt 21
14	373.2	3881.7	0.00	0.000	0.010	28.7	0.4	15.9	298.	14 Ideal Cement pt 22
15	371.2	3881.7	0.00	0.000	0.220	15.2	2.6	12.1	561.	15 Ideal Cement pt 23
16	373.2	3881.7	0.00	0.000	0.240	15.2	2.6	12.1	561.	16 Ideal Cement pt 24
17	373.2	3881.7	0.00	0.000	0.440	32.6	2.4	11.9	366.	17 Ideal Cement pt 25
18	371.2	3881.7	0.00	0.000	0.003	38.4	0.5	12.3	298.	18 Ideal Cement pt 26
19	373.2	3881.7	0.00	0.000	0.010	9.5	0.5	18.7	298.	19 Ideal Cement pt 1
20	373.2	3881.7	0.00	0.000	0.010	9.5	0.5	18.7	298.	20 Ideal Cement pt 2
21	371.2	3881.7	0.00	0.000	0.010	10.9	0.5	18.7	298.	21 Ideal Cement pt 3
22	373.2	3881.7	0.00	0.000	0.010	34.7	0.4	18.1	298.	22 Ideal Cement pt 4
23	373.2	3881.7	0.00	0.000	0.010	34.7	0.4	18.1	298.	23 Ideal Cement pt 5
24	371.2	3881.7	0.00	0.000	0.010	34.7	0.4	18.1	298.	24 Ideal Cement pt 6
25	373.2	3881.7	0.00	0.000	0.010	34.7	0.4	18.1	298.	25 Ideal Cement pt 7
26	373.2	3881.7	0.00	0.000	0.010	5.1	0.4	18.1	298.	26 Ideal Cement pt 8
27	371.2	3881.7	0.00	0.000	0.010	33.8	0.4	16.6	298.	27 Ideal Cement pt 9
28	373.2	3881.7	0.00	0.000	0.010	33.8	0.7	4.9	298.	28 Ideal Cement pt 10
29	373.2	3881.7	0.00	0.000	0.020	29.3	0.7	16.6	350.	29 Ideal Cement pt 11
30	371.2	3881.7	0.00	0.000	0.010	29.3	0.5	11.4	333.	30 Ideal Cement pt 12
31	373.2	3881.7	0.00	0.000	0.020	29.3	0.6	23.6	300.	31 Ideal Cement pt 13
32	373.2	3881.7	0.00	0.000	0.010	30.2	0.5	24.2	298.	32 Ideal Cement pt 27
33	371.2	3881.7	0.00	0.000	0.010	30.2	0.5	24.2	298.	33 Ideal Cement pt 28
34	373.2	3881.7	0.00	0.000	0.010	29.3	0.7	19.9	333.	34 Ideal Cement pt 29
35	373.2	3881.7	0.00	0.000	0.010	29.3	0.5	15.7	319.	35 Ideal Cement pt 30
36	371.2	3881.7	0.00	0.000	0.010	29.3	0.6	23.6	294.	36 Ideal Cement pt 31
37	373.2	3881.7	0.00	0.000	0.010	29.3	1.0	9.9	333.	37 Ideal Cement pt 32
38	373.2	3881.7	0.00	0.000	0.000	29.3	0.5	15.7	319.	38 Ideal Cement pt 33
39	371.2	3881.7	0.00	0.000	0.010	29.3	0.6	23.6	294.	39 Ideal Cement pt 34
40	373.2	3881.7	0.00	0.000	0.003	47.9	0.4	21.8	298.	40 Ideal Cement pt 35
41	373.2	3881.7	0.00	0.000	0.003	47.9	0.4	21.8	298.	41 Ideal Cement pt 36
42	371.2	3881.7	0.00	0.000	0.003	20.4	0.4	21.8	298.	42 Ideal Cement pt 37
43	373.2	3881.7	0.00	0.000	0.003	20.4	0.4	21.8	298.	43 Ideal Cement pt 38
44	373.2	3881.7	0.00	0.000	0.003	20.4	0.4	21.8	298.	44 Ideal Cement pt 39
45	371.2	3881.7	0.00	0.000	0.003	20.4	0.4	21.8	298.	45 Ideal Cement pt 40
46	373.2	3881.7	0.00	0.000	0.003	54.6	0.4	15.9	298.	46 Ideal Cement pt 41
47	354.2	3893.2	0.00	0.000	0.070	9.1	1.4	10.1	352.	47 Kent Knowlins Construction
48	378.0	3588.6	0.00	0.000	0.070	9.1	1.4	6.6	352.	48 Kent Knowlins Construction pt 2
49	348.6	3875.6	0.00	0.000	0.003	4.6	0.8	3.0	1033.	49 Kinney Brick
50	358.9	3880.5	0.00	0.000	0.003	17.4	1.4	0.0	511.	50 Kirtland Air Force Base
51	350.3	3877.2	0.00	0.000	0.020	20.1	2.3	10.8	411.	51 Public Service Co Person Station
52	350.3	3877.2	0.00	0.000	0.020	20.1	2.3	10.2	411.	52 Public Service Co Person Station pt 2
53	350.3	3877.2	0.00	0.000	0.040	21.0	2.4	14.1	415.	53 Public Service Co Person Station pt 3
54	350.3	3877.2	0.00	0.000	0.040	21.0	2.4	15.6	426.	54 Public Service Co Person Station pt 4
55	353.3	3893.3	0.00	0.000	1.560	6.1	1.5	8.3	361.	55 Wylie Brothers
56	351.0	3888.5	0.00	0.000	0.003	9.1	0.6	0.4	383.	56 S.W. Vermiculite
57	351.2	3886.7	0.00	0.000	0.005	0.1	0.2	6.0	298.	57 Springer Corp.
58	351.2	3886.7	0.00	0.000	0.010	9.1	2.0	3.0	298.	58 Springer Corp. pt 2

59	349.4	3881.3	0.00	0.000	0.003	10.7	0.7	6.0	298.	59	Springer, Trumbell & Garcia
60	349.4	3881.3	0.00	0.000	0.003	9.1	2.0	3.0	298.	60	Springer, Trumbell & Garcia pt 2
61	344.2	3879.8	0.00	0.000	0.003	9.1	0.6	20.4	325.	61	Star Paving
62	344.2	3879.8	0.00	0.000	0.003	10.7	0.7	0.4	298.	62	Star Paving pt 2
63	358.8	3880.4	0.00	0.000	0.003	18.3	1.5	15.3	448.	63	Sandia Labs
64	358.8	3880.4	0.00	0.000	0.003	9.1	0.9	1.5	366.	64	Sandia Labs pt 3
65	358.8	3880.4	0.00	0.000	0.008	18.9	1.5	9.4	417.	65	Sandia Labs pt 4
66	358.8	3880.4	0.00	0.000	0.008	19.2	1.2	12.3	533.	66	Sandia Labs pt 5
67	358.8	3880.4	0.00	0.000	0.008	19.2	1.2	12.3	533.	67	Sandia Labs pt 6
68	358.8	3880.4	0.00	0.000	0.008	19.2	1.2	12.3	533.	68	Sandia Labs pt 7
69	358.8	3880.4	0.00	0.000	0.008	19.2	1.2	12.3	533.	69	Sandia Labs pt 8
70	353.5	3890.5	0.00	0.000	0.050	5.5	1.4	8.1	333.	70	University Construction
71	353.5	3890.5	0.00	0.000	0.050	5.5	1.4	8.1	333.	71	University Construction pt 2
72	358.8	3879.5	0.00	0.000	0.005	10.1	0.4	5.6	422.	72	Lovelure Research
73	357.0	3892.0	0.00	0.000	0.003	10.7	0.7	6.0	298.	73	Shriver Concrete
74	354.4	3893.0	0.00	0.000	0.050	36.0	2.7	13.5	410.	74	Public Service Corp.
75	354.4	3893.0	0.00	0.000	0.050	36.0	2.7	13.5	411.	75	Public Service Corp. pt 2
76	354.4	3893.0	0.00	0.000	0.090	36.0	3.0	15.6	412.	76	Public Service Corp. pt 3
77	348.3	3885.6	0.00	0.000	0.060	10.0	1.0	2.0	298.	77	Paxton Lumber
78	343.0	3875.8	0.00	0.000	0.020	9.1	2.0	10.0	298.	78	Valley Concrete
79	348.3	3885.7	0.00	0.000	0.020	19.8	4.3	0.0	298.	79	Duke City
80	349.6	3879.3	0.00	0.000	0.020	4.6	0.8	7.8	301.	80	General Electric
81	349.6	3879.3	0.00	0.000	0.030	5.5	1.0	6.6	300.	81	General Electric pt 75
82	349.6	3879.3	0.00	0.000	0.003	5.5	1.0	6.0	300.	82	General Electric pt 65
83	349.6	3879.3	0.00	0.000	0.003	3.7	0.5	9.3	355.	83	General Electric pt 66
84	349.6	3879.0	0.00	0.000	0.003	3.0	0.7	16.0	304.	84	General Electric pt 81
85	355.0	3894.3	0.25	0.000	0.010	3.0	0.0	0.0	0.	85	2-G Grid H Dirt Road
86	355.5	3894.3	0.25	0.000	0.034	3.0	0.0	0.0	0.	86	2-G Grid B Dirt Road
87	355.5	3894.3	0.25	0.000	0.112	3.0	0.0	0.0	0.	87	2-G Grid B Dirt Road
88	356.1	3894.3	0.25	0.000	0.098	3.0	0.0	0.0	0.	88	2-G Grid G Dirt Road
89	356.1	3894.3	0.25	0.000	0.063	3.0	0.0	0.0	0.	89	2-G Grid D Dirt Road
90	357.1	3893.6	0.25	0.000	0.670	3.0	0.0	0.0	0.	90	2-G Grid J Dirt Road
91	357.1	3893.6	0.25	0.000	0.010	3.0	0.0	0.0	0.	91	2-G Grid J Dirt Road
92	357.1	3893.6	0.25	0.000	0.055	3.0	0.0	0.0	0.	92	2-G Grid J Dirt Road
93	355.0	3893.1	0.25	0.000	0.170	3.0	0.0	0.0	0.	93	2-G Grid L Dirt Road
94	355.5	3893.1	0.25	0.000	0.015	3.0	0.0	0.0	0.	94	2-G Grid M Dirt Road
95	356.1	3893.1	0.25	0.000	0.182	3.0	0.0	0.0	0.	95	2-G Grid N Dirt Road
96	356.1	3893.1	0.25	0.000	0.078	3.0	0.0	0.0	0.	96	2-G Grid N Dirt Road
97	356.6	3893.1	0.25	0.000	0.036	3.0	0.0	0.0	0.	97	2-G Grid O Dirt Road
98	355.0	3892.5	0.25	0.000	0.045	3.0	0.0	0.0	0.	98	2-G Grid R Dirt Road
99	355.0	3892.5	0.25	0.000	0.045	3.0	0.0	0.0	0.	99	2-G Grid R Dirt Road
100	355.5	3892.5	0.25	0.000	0.520	3.0	0.0	0.0	0.	100	2-G Grid S Dirt Road
101	355.5	3892.5	0.25	0.000	0.078	3.0	0.0	0.0	0.	101	2-G Grid S Dirt Road
102	355.7	3892.5	0.25	0.000	0.000	3.0	0.0	0.0	0.	102	2-G Grid T Dirt Road
103	355.5	3892.0	0.25	0.000	0.335	3.0	0.0	0.0	0.	103	2-G Grid Y Dirt Road
104	356.6	3891.5	0.25	0.000	0.224	3.0	0.0	0.0	0.	104	2-G Grid EE Dirt Road
105	357.1	3891.5	0.25	0.000	0.056	3.0	0.0	0.0	0.	105	2-G Grid FF Dirt Road
106	350.1	3886.3	0.25	0.000	0.056	3.0	0.0	0.0	0.	106	2-C Grid X Reentrained Dust (.006 tire/exh)
107	350.3	3887.8	0.25	0.000	0.011	3.0	0.0	0.0	0.	107	2-C Grid A Tire & Exhaust
108	350.6	3887.6	0.25	0.000	0.035	3.0	0.0	0.0	0.	108	2-C Grid B Re-entrained Dust(0.11 tire/exh)
109	351.4	3887.3	0.25	0.000	0.093	3.0	0.0	0.0	0.	109	2-C Grid C Re-entrained Dust
110	351.1	3887.6	0.25	0.000	1.630	3.0	0.0	0.0	0.	110	2-C Grid D Unpaved Carmony Road
111	351.1	3887.3	0.25	0.000	0.002	3.0	0.0	0.0	0.	111	2-C Grid H Re-entrained Dust
112	350.6	3887.3	0.25	0.000	0.138	3.0	0.0	0.0	0.	112	2-C Grid G Re-entrained Dust
113	351.1	3887.3	0.25	0.000	0.093	3.0	0.0	0.0	0.	113	2-C Grid H Re-entrained Dust
114	351.2	3886.4	0.25	0.000	0.001	3.0	0.0	0.0	0.	114	2-C Grid Z Tire & Exhaust
115	350.7	3886.3	0.25	0.000	0.008	3.0	0.0	0.0	0.	115	2-C Grid W Tire & Exhaust
116	350.6	3886.3	0.25	0.000	0.041	3.0	0.0	0.0	0.	116	2-C Grid Y Re-entrained Dust
117	351.7	3886.3	0.25	0.000	0.006	3.0	0.0	3.0	0.	117	2-C Grid AA Re-entrained Dust
118	351.7	3887.9	0.25	0.000	0.009	3.0	0.0	0.0	0.	118	2-C Grid I Tire & Exhaust
119	351.7	3887.9	0.25	0.000	0.380	3.0	0.0	0.0	0.	119	2-C Grid I Dirt Road
120	352.1	3887.9	0.25	0.000	0.176	3.0	0.0	0.0	0.	120	2-C Grid J Dirt Lot (.005 tire/exh)
121	350.6	3887.2	0.25	0.000	0.030	3.0	0.0	0.0	0.	121	2-C Grid M Dirt Road
122	350.6	3887.2	0.25	0.000	0.210	3.0	0.0	0.0	0.	122	2-C Grid M Dirt Road
123	351.2	3887.3	0.25	0.000	0.180	3.0	0.0	0.0	0.	123	2-C Grid N Dirt Road
											2-C Grid N Dirt Road

125	350.2	3887.3	0.25	0.000	0.060	3.0	0.0	0.0	0.	125	2-C Grid N Dirt Road
126	350.2	3887.3	0.25	0.000	0.114	3.0	0.0	0.0	0.	126	2-C Grid N Dirt Road
127	351.2	3887.3	0.25	0.000	0.093	3.0	0.0	0.0	0.	127	2-C Grid N Re-entrained Dust
128	352.2	3887.4	0.25	0.000	0.005	3.0	0.0	0.0	0.	128	2-C Grid P Tire & Exhaust
129	352.2	3886.4	0.25	0.000	0.005	3.0	0.0	0.0	0.	129	2-C Grid BB Tire & Exhaust
130	351.7	3886.4	0.25	0.000	0.001	3.0	0.0	0.0	0.	130	2-C Grid AA Tire & Exhaust
131	349.4	3886.3	0.25	0.000	0.005	3.0	0.0	0.0	0.	131	2-C Grid CC Tire & Exhaust
132	349.7	3886.3	0.25	0.000	0.005	3.0	0.0	0.0	0.	132	2-C Grid DD Tire & Exhaust
133	349.4	3884.5	0.25	0.000	0.005	3.0	0.0	0.0	0.	133	2-A Grid A Tire & Exhaust
134	348.9	3884.0	0.25	0.000	0.005	3.0	0.0	0.0	0.	134	2-A Grid E Tire & Exhaust
135	348.9	3883.5	0.25	0.000	0.040	3.0	0.0	0.0	0.	135	2-A Grid K Tire & Exhaust
136	348.9	3883.3	0.25	0.000	0.015	3.0	0.0	0.0	0.	136	2-A Grid Q Tire & Exhaust
137	348.9	3882.5	0.25	0.000	0.005	3.0	0.0	0.0	0.	137	2-A Grid W Tire & Exhaust
138	349.4	3882.0	0.25	0.000	0.008	3.0	0.0	0.0	0.	138	2-A Grid CC Tire & Exhaust
139	349.9	3882.0	0.25	0.000	0.007	3.0	0.0	0.0	0.	139	2-A Grid DD Tire & Exhuast
140	350.4	3882.0	0.25	0.000	0.025	3.0	0.0	0.0	0.	140	2-A Grid EE Tire & Exhaust
141	350.4	3882.5	0.25	0.000	0.123	3.0	0.0	0.0	0.	141	2-A Grid Z Tire & Exhaust
142	350.4	3883.0	0.25	0.000	0.029	3.0	0.0	0.0	0.	142	2-A Grid T Tire & Exhaust
143	350.4	3883.6	0.25	0.000	0.011	3.0	0.0	0.0	0.	143	2-A Grid N Tire & Exhaust
144	350.4	3884.0	0.25	0.000	0.011	3.0	0.0	0.0	0.	144	2-A Grid N Tire & Exhaust
145	349.4	3884.0	0.25	0.000	0.003	3.0	0.0	0.0	0.	145	2-A Grid F Tire & Exhaust
146	349.4	3884.3	0.25	0.000	0.148	3.0	0.0	0.0	0.	146	2-A Grid L Tire & Exhaust
147	349.9	3884.0	0.25	0.000	0.010	3.0	0.0	0.0	0.	147	2-A Grid G Tire & Exhaust
148	349.9	3883.5	0.25	0.000	0.153	3.0	0.0	0.0	0.	148	2-A Grid M Tire & Exhaust
149	349.9	3884.5	0.25	0.000	0.012	3.0	0.0	0.0	0.	149	2-A Grid B Tire & Exhaust
150	350.9	3884.5	0.25	0.000	0.005	3.0	0.0	0.0	0.	150	2-A Grid D Tire & Exhaust
151	350.4	3884.6	0.25	0.000	0.009	3.0	0.0	0.0	0.	151	2-A Grid C Tire & Exhaust
152	349.9	3883.0	0.25	0.000	0.250	3.0	0.0	0.0	0.	152	2-A Grid S Locomotive
153	349.4	3883.0	0.25	0.000	0.013	3.0	0.0	0.0	0.	153	2-A Grid R Tire & Exhaust
154	350.9	3883.0	0.25	0.000	0.007	3.0	0.0	0.0	0.	154	2-A Grid U Tire & Exhaust
155	350.9	3884.5	0.25	0.000	0.007	3.0	0.0	0.0	0.	155	2-A Grid O Tire & Exhaust
156	350.4	3884.6	0.25	0.000	0.070	3.0	0.0	0.0	0.	156	2-A Grid C Unpaved Lot
157	350.9	3884.6	0.25	0.000	0.090	3.0	0.0	0.0	0.	157	2-A Grid D Unpaved Lot
158	350.9	3884.1	0.25	0.000	0.007	3.0	0.0	0.0	0.	158	2-A Grid I Unpaved Lot
159	349.8	3883.6	0.25	0.000	0.110	3.0	0.0	0.0	0.	159	2-A Grid M Unpaved Lot
160	349.8	3883.6	0.25	0.000	0.080	3.0	0.0	0.0	0.	160	2-A Grid M Unpaved Lot
161	349.8	3883.6	0.25	0.000	0.280	3.0	0.0	0.0	0.	161	2-A Grid M Unpaved Lot
162	350.4	3883.6	0.25	0.000	0.060	3.0	0.0	0.0	0.	162	2-A Grid N Unpaved Lot
163	351.4	3883.6	0.25	0.000	0.010	3.0	0.0	0.0	0.	163	2-A Grid P Unpaved Lot
164	350.4	3883.0	0.25	0.000	0.020	3.0	0.0	0.0	0.	164	2-A Grid T Unpaved Lot
165	349.8	3882.5	0.25	0.000	0.030	3.0	0.0	0.0	0.	165	2-A Grid Y Unpaved Lot
166	349.3	3882.0	0.25	0.000	0.080	3.0	0.0	0.0	0.	166	2-A Grid CC Unpaved Lot
167	349.3	3882.0	0.25	0.000	0.056	3.0	0.0	0.0	0.	167	2-A Grid CC Unpaved Lot
168	349.0	3882.0	0.25	0.000	0.014	3.0	0.0	0.0	0.	168	2-A Grid DD Unpaved Lot
169	350.4	3882.0	0.25	0.000	0.050	3.0	0.0	0.0	0.	169	2-A Grid EE Unpaved Lot
170	355.9	3885.9	0.25	0.000	0.016	3.0	0.0	0.0	0.	170	2-P Grid E Tire & Exhaust
171	355.9	3885.6	0.25	0.000	0.006	3.0	0.0	0.0	0.	171	2-P Grid K Tire & Exhaust
172	355.4	3885.2	0.25	0.000	0.001	3.0	0.0	0.0	0.	172	2-P Grid Q Tire & Exhaust
173	355.7	3885.9	0.25	0.000	0.016	3.0	0.0	0.0	0.	173	2-P Grid A Tire & Exhaust
174	355.4	3885.9	0.25	0.000	0.008	3.0	0.0	0.0	0.	174	2-P Grid B Tire & Exhaust
175	355.6	3885.9	0.25	0.000	0.009	3.0	0.0	0.0	0.	175	2-P Grid C Tire & Exhaust
176	355.9	3885.9	0.25	0.000	0.018	3.0	0.0	0.0	0.	176	2-P Grid D Tire & Exhaust
177	356.7	3885.2	0.25	0.000	0.006	3.0	0.0	0.0	0.	177	2-P Grid J Tire & Exhaust
178	356.4	3886.2	0.25	0.000	0.015	3.0	0.0	0.0	0.	178	2-P Grid H Tire & Exhaust
179	356.1	3885.5	0.25	0.000	0.006	3.0	0.0	0.0	0.	179	2-P Grid G Tire & Exhaust
180	355.9	3885.5	0.25	0.000	0.018	3.0	0.0	0.0	0.	180	2-P Grid F Tire & Exhaust
181	355.9	3885.2	0.25	0.000	0.005	3.0	0.0	0.0	0.	181	2-P Grid R Tire & Exhaust
182	356.6	3885.7	0.25	0.000	0.007	3.0	0.0	0.0	0.	182	2-P Grid N Tire & Exhaust
183	356.1	3885.7	0.25	0.000	0.018	3.0	0.0	0.0	0.	183	2-P Grid I Tire & Exhaust
184	356.1	3885.2	0.25	0.000	0.045	3.0	0.0	0.0	0.	184	2-P Grid S Re-entrained Dust
185	356.1	3885.2	0.25	0.000	0.029	3.0	0.0	0.0	0.	185	2-P Grid T Re-entrained Dust
186	356.8	3884.9	0.25	0.000	0.000	3.0	0.0	0.0	0.	186	2-P Grid Emission too small
187	356.1	3885.7	0.25	0.000	0.160	3.0	0.0	0.0	0.	187	2-P Grid M Unpaved Lot
188	356.6	3886.2	0.25	0.000	0.020	3.0	0.0	0.0	0.	188	2-P Grid H Unpaved Road
189	356.6	3885.7	0.25	0.000	0.020	3.0	0.0	0.0	0.	189	2-P Grid N Unpaved Lot
190	356.1	3885.2	0.25	0.000	0.010	3.0	0.0	0.0	0.	190	

191	356.1	3885.2	0.25	0.000	0.030	3.0	0.0	0.0	0.	191	2-P Grid T Unpaved Lot
192	356.1	3885.2	0.25	0.000	0.010	3.0	0.0	0.0	0.	192	2-P Grid T Unpaved Lot
193	356.1	3885.2	0.25	0.000	0.020	3.0	0.0	0.0	0.	193	2-P Grid T Re-entrained Dust
194	353.6	3890.7	0.02	0.000	0.690	9.1	0.0	0.0	0.	194	Albuquerque Gravel pt 3
195	353.6	3890.7	0.01	0.000	0.110	9.1	0.0	0.0	0.	195	Albuquerque Gravel pt 4
196	360.2	3879.1	0.01	0.000	0.005	9.1	0.0	0.0	0.	196	Albuquerque Eubank pt 2
197	360.2	3879.1	0.02	0.000	0.020	9.1	0.0	0.0	0.	197	Albuquerque Eubank pt 3
198	354.8	3893.8	0.01	0.000	0.400	9.1	0.0	0.0	0.	198	American Gypsum
199	352.0	3888.0	0.01	0.000	0.040	9.1	0.0	0.0	0.	199	Hale Construction pt 2
200	352.0	3888.0	0.02	0.000	0.010	9.1	0.0	0.0	0.	200	Hale Construction pt 3
201	323.2	3881.7	0.02	0.000	0.110	9.1	0.0	0.0	0.	201	Ideal Cement pt 2
202	378.0	3588.6	0.01	0.000	0.210	9.1	0.0	0.0	0.	202	Kent Knowlins pt 2
203	378.0	3588.6	0.02	0.000	0.020	9.1	0.0	0.0	0.	203	Kent Knowlins pt 3
204	351.3	3893.3	0.01	0.000	0.540	9.1	0.0	0.0	0.	204	Wylie Brothers pt 2
205	351.3	3893.3	0.02	0.000	0.005	9.1	0.0	0.0	0.	205	Wylie Brothers pt 3
206	351.2	3886.7	0.01	0.000	0.270	9.1	0.0	0.0	0.	206	Springer Corp. pt 3
207	352.8	3893.4	0.01	0.000	0.100	9.1	0.0	0.0	0.	207	Springer Corp. Edith Blvd.
208	352.8	3893.4	0.01	0.000	0.420	9.1	0.0	0.0	0.	208	Springer Corp. Edith Blvd. pt 2
209	352.8	3893.4	0.02	0.000	0.200	9.1	0.0	0.0	0.	209	Springer Corp. Edith Blvd. pt 3
210	349.4	3881.3	0.01	0.000	0.070	9.1	0.0	0.0	0.	210	Springer Corp. Trumbell pt 3
211	349.4	3881.3	0.02	0.000	0.010	9.1	0.0	0.0	0.	211	Springer Corp. Trumbell pt 4
212	344.2	3879.8	0.01	0.000	0.020	9.1	0.0	0.0	0.	212	Star Paving pt 3
213	353.5	3890.5	0.01	0.000	0.160	9.1	0.0	0.0	0.	213	Universal Construction pt 3
214	353.5	3890.5	0.02	0.000	0.010	9.1	0.0	0.0	0.	214	Universal Construction pt 4
215	357.5	3883.5	0.25	0.000	0.014	3.0	0.0	0.0	0.	215	2-K Grid A Re-entrained Dust
216	358.4	3883.5	0.25	0.000	0.000	3.0	0.0	0.0	0.	216	2-K Grid Emission too small
217	358.7	3883.5	0.25	0.000	0.000	3.0	0.0	0.0	0.	217	2-K Grid Emission too small
218	357.0	3883.0	0.25	0.000	0.013	3.0	0.0	0.0	0.	218	2-K Grid F Fair Grounds
219	358.0	3883.0	0.25	0.000	0.030	3.0	0.0	0.0	0.	219	2-K Grid H Unpaved Driveways
220	358.5	3883.0	0.25	0.000	0.020	3.0	0.0	0.0	0.	220	2-K Grid Y Unpaved Driveways
221	357.4	3882.2	0.25	0.000	0.029	3.0	0.0	0.0	0.	221	2-K Grid FF Unpaved Driveways
222	357.7	3882.2	0.25	0.000	0.000	3.0	0.0	0.0	0.	222	2-K Grid Emission too small
223	357.9	3882.2	0.25	0.000	0.080	3.0	0.0	0.0	0.	223	2-K Grid JJ Unpaved Driveways
224	357.4	3882.2	0.25	0.000	0.048	3.0	0.0	0.0	0.	224	2-K Grid KK Unpaved Driveways
225	357.5	3882.1	0.25	0.000	0.020	3.0	0.0	0.0	0.	225	2-K Grid T Unpaved Driveways
226	357.2	3882.1	0.25	0.000	0.000	3.0	0.0	0.0	0.	226	2-K Grid Emission too small
227	356.0	3881.8	0.25	0.000	0.006	3.0	0.0	0.0	0.	227	2-K Grid X Tire & Exhaust
228	357.7	3881.8	0.25	0.000	0.008	3.0	0.0	0.0	0.	228	2-K Grid BB Tire & Exhaust
229	356.0	3881.6	0.25	0.000	0.006	3.0	0.0	0.0	0.	229	2-K Grid DD Tire & Exhaust
230	357.0	3892.0	0.01	0.000	0.050	9.1	0.0	0.0	0.	230	Shriver Construction

MODEL DESCRIPTIONS

For years, investigators have successfully used meteorological data and mass emission rates in mathematical dispersion models to predict downwind concentrations of pollutants. Such modeling has shown moderate success under simple conditions, that is, flat terrain, uniform winds, and neutral atmospheric conditions. However, even with a constant rate of emission, ground level concentrations may show instantaneous variations by a factor of 1,000 because of atmospheric fluctuations such as gusty winds, inversions, and mountainous terrain. In all instances, the role of meteorology is of paramount importance in assessing the impact of any source. Once the material is in the air, meteorological conditions determine its fate. It is transported and diluted by air motion, it undergoes physical and chemical change such as hydration or photochemical reaction and it may take a hand in things itself by having sufficiently high settling velocity to fall out. Ultimately, it reaches a receptor. If the nature and concentration of the airborne material is such that it is harmful to human, vegetable, or animal life, or is a nuisance, then the situation of air pollution exists. If there are no sensitive receptors in its path or if it is sufficiently diluted or transformed before it reaches the receptor, it will be neither harmful or a nuisance. This last point is often neglected. The atmosphere has a tremendous self-cleansing capability. If this were not so, the air quality of the entire world would have long since been incapable of supporting life. For instance, after SO_2 is released from a stack, it reacts with the water vapor in the air to form a sulfuric acid mist which is soon converted to sulfates such as ammonium and calcium sulfate. It has been estimated that the turnover time for SO_2, with the subsequent reactions, is 43 days or less, on the average.[1]

[1]Stern, Arthur C., Air Pollution (Volume 1, Chapter 6), Academic Press, New York, N.Y., 1968. (Haagen-Smit and Wayne)

The model which was used in the preparation of this report is the Air Quality Display Model (AQDM) developed for the U.S. Department of Health, Education and Welfare, National Air Pollution Control Administration. This is the predecessor organization of the U.S. Environmental Protection Agency. The model was completed in 1969 and was intended to help state and local air pollution agencies evaluate the effect of emission regulations on ambient air quality. The AQDM was originally developed by Martin-Tikvart in 1968 and they have made several simplifying assumptions that differ from the work completed by Turner, Pasquill-Gifford, and others. These modifications will be discussed later. The specific computer program was obtained from the U.S. EPA in North Carolina in the fall of 1973 with program changes supplied by EPA for incorporating the Briggs plume rise equation. The 1969 version of AQDM utilized the Holland equation when calculating plume height. All AQDM runs were made on an IBM 370/155 computer.

The model inputs included meteorological data, point and area source emission data and air quality (calibration) data. The emission stack configuration parameters are also required to estimate annual average ground level concentrations of sulfur dioxide. Other inputs regarding study area location and grid spacing were also included. For most of the runs, ES used a grid spacing of 1 kilometer (3048 feet) and 15 rows and 15 columns for 225 receptors.

Assumptions of the EPA Air Quality Display Model

It was not within the scope of this study to conduct a quantitative analysis of the dispersion equation utilized in the AQDM. On the other hand, it is important to point out key assumptions that have been made in simplifying the basic equations for use in this dispersion model.

There is very little difference in any of the presently published air quality dispersion models. All of the models assume some form of conical dispersion pattern and make assumptions about the terrain and secondary atmospheric reactions which help reduce the number of input parameters. Frequently, investigators tailor a model to their local conditions by measuring air quality and then applying correction factors to different portions of the dispersion equation. In subsequent sections

of this chapter, the Briggs and Holland plume rise equations are discussed. The two different plume rise equations result in two different ground level concentrations. The Holland equation generally predicts ground level concentrations that are higher than those when using the Briggs equation.

In 1969, when the model was built, Holland was in fact the preferred equation. However, at the present time, EPA meteorologists are advising use of the Briggs equation.

The EPA/AQDM was developed to estimate ambient air concentrations over a very large built up metropolitan area. The developers of the EPA/AQDM used Chicago as their test city and obvious inputs to the model included a number of area, point and transportation sources. For calibration of the model, the developers had available an abundance of air quality data representing various averaging times and collected over several years.

One of the key differences that has been made in the AQDM which differs slightly from earlier investigators is the treatment of the crosswind deviations (σ_y). Most investigators assume the Gaussian distribution. The AQDM, distribution in the EPA/AQDM is more applicable to large built up metropolitan areas where channeling, turbulence, and multiple sources create a more uniform distribution of the ground level concentrations. In rural situations involving several point sources, other investigators have used the Gaussian distribution for the σ_y's and σ_z's.[2] The effect on ground level concentrations of using a linear distribution would probably be to estimate lower maximum ground level values. Furthermore, the expected location of the maximum may differ from those formulae assuming a Gaussian distribution for σ_y.

[2]Jepsen, A.F. and Weil, J.C., Maryland Power Plant Air Monitoring Program Preliminary Results, presented at APCA Meeting in Chicago, June 1973, (Paper No. 73-147).